HEURISTICKÉ VYUČOVACÍ METODY V DIDAKTICE VYSOKOŠKOLSKÉ VÝUKY

HEURISTIC TEACHING METHODS IN THE DIDACTICS OF UNIVERSITY EDUCATION

DENIS MAINZ

Resumé
Příspěvek je věnován problematice zájmu žáků a studentů o vysokoškolské studium přírodovědných oborů a klade si za cíl charakterizovat heuristické vyučovací metody a konstruktivistické principy vysokoškolské výuky, které by mohly přispět ke zvyšování zájmu o studium nehumanitně orientovaných vysokoškolských oborů.

Abstract
This paper discusses the interests of pupils and students of the university scientific disciplines and it aims to characterize the heuristic teaching methods and constructivist principles of university teaching, which could contribute to increasing interest in the study of non humanities-oriented disciplines at university.

INTRODUCTION

Universities as an institutions have in our country's long tradition as in the past, so today Colleges system undergoes various changes that quite a few related to the social and political changes in society. These changes will then be reflected also in the increased interest of young people studying at the university, which was reported in the past decade. This fact is known from various media and statistics published in the Czech Republic [1], but also in other European countries [2]. What is in this context it publishes less information, which would clarify whether, in this interest (on) existing university students conceals a desire for higher education as such and more prevalent demand for proof of ownership and valid certificate of graduation school.

INTEREST TO STUDY AT UNIVERSITY

The controversy over these two different approaches contribute data substantiated the fact in the form of an overall growing interest in studying at universities, while declining interest in academic scientific disciplines. This issue has been investigated in the last few years in many national and international studies conducted by different methods of collecting and processing data on different samples of respondents from different levels of education [1], [3], [6], [7]. "The interest of students in science as a subject of research studies and application problems of their results in educational practice" analyzes the M. Bílek [4].

Reported studies are dedicated to the discovery of interest in science subjects, and indicate the level of their popularity among students at different stages of education. The conclusions of those studies coincide in the fact that the majority of respondents aware of the importance of science subjects, but the results also show that students have a high interest in these subjects addressed. Given issues are also dedicated worldwide organization for Economic Cooperation and Development (OECD) in 2006 in the report "Evolution of Student Interest in Science and Technology Studies", based surveys, published answers as to why scientists are perceived by students (students) positively and yet for them to scientific or technical profession less attractive.

In its conclusions, the OECD states that a frequent cause is the fact that young people do not have a clear vision and sufficient knowledge or often stereotyped as to what they actually are scientific and technical professions and what the experts in these areas are actually doing. One of the other reasons that leads pupils (students) to reduced interest in science and the study of sciences is that the continuation of the study disciplines and the entire careers of scientists is often associated with demands for better knowledge and understanding. It also showed that among the scientific and technical disciplines that are most affected by the lack of student interest include those with substantial theoretical content of mathematics, physics and chemistry. For students, the second and third levels of education, these courses must often compete with the new and modern as management, marketing, media communication, etc. Or branches currently sought after in the labor market. [3]

Similar research with even more specific conclusions was made in 2007 in the EU expert group headed by M. Rocard. The subject of investigation was also interested pupils and students in science, this time in the individual EU member states. The final report of this research was reached the following conclusion: "One of the main causes of waning interest among young people in science studies are considered the ways in which science is taught in schools." [5]

SOLUTION THAT FOLLOWS FROM THE RESULTS OF STUDIES

OECD came up with some recommendations, which should help to reverse the current situation. One of them concerns the fact that pupils (students) must have access to the right and credible information on scientific and technical professions and must avoid their unrealistic or exaggerated representation. It should be evaluated by independent observers and provided the school, parents and the pupils themselves. Better information on these professions should then be provided directly by professionals. The report points out that training in scientific and technical fields and curricula of these areas should be reformed. [3]

Further reforms also do not form. It could be a change in the current model schools still oriented rather on the curriculum and teacher [8] (p.79) to model-oriented school pupil (constructive model) [8] (pg. 82)? Researchers led by M. Rocard in this context are more specific and recommended to increase students' interest in science subjects transition from deductive teaching methods (in which the proceeds from the general definitions, concepts and principles to be applied to specific events and examples) for research-oriented teaching methods. These are conducted in the research proved effective in increasing the interest of pupils (students) primary and secondary education in the sciences. Also thanks to them, pupils (students) in so oriented subjects achieved better results and even an inquiry-based learning methods positively stimulate the motivation of teachers to guide instruction in this way. [5]

These knowledge could be further expanded by finding that the principles of inquiry-based learning and other heuristic (problem, research, research) activity teaching methods (problem, project etc.), We can find common elements with those that apply in certain principles university education, especially in the application of constructivist model, where "student uses his experience and knowledge-teaching preconceptions and constructing their own knowledge discovery." [13]

PRINCIPLES OF HEURISTIC AND RESEARCH ACTIVISING TEACHING METHODS

One of the main principles of heuristic is to promote and stimulate the desire for knowledge, detection, discovery. In other words, the application of these methods allows arouse curiosity in students and helps to fulfill the natural need to find solutions. "Curiosity is the driving force of the results." (Sir Kenneth Robinson)

"Students are required to seek knowledge, reveal new relation, and thus develop their thinking and cognitive processes and acquire intellectual skills." [11] (p. 87) "Through heuristic methods the teacher tries to get students for independent, responsible action learning different techniques that is to support discovery, searching, finding, for example. the problem by asking questions, exposure to various contradictions and problems, familiarization with interesting cases and situations, etc. "[12] (p. 113) The classification of teaching methods by IJ Lerner can be found with the distribution method, except where specifically cited heuristic method research. After studying both of these methods, it can be concluded that apart for principal fundamentally different. Even the heuristic method referred to by some authors as partly research. The main difference between the two methods is evident in the activity of the teacher during lessons conducted research method fades into the background - controls the process solutions and intervenes only when threatened that students not gather from the right path. The heuristic method, the teacher not only controls the process solution, but more often manages and directs the activities of students, gradually creates a situation creates a problem by itself or together with pupils determines the individual steps or partial solution to the main problem. [14]

Among heuristic research and activising teaching methods can include:

- problem-based method (problem-solving method)
- project-based method
- inquiry-based learning
- Delphi method

PROBLEM-BASED LEARNING

Problem solving method is considered an ideological variant of learning by trial and error, in which students learn not only from their successes but also mistakes and failures. [12]

When applying methods troubled teacher transforms the basic curriculum into the problem task. This means that an abstract or realistic problem situation that makes all the important information is allowed to invent, or to determine the students themselves. [15] The teacher in this case acts as the main problem outsourcer. Its mission is to initiate such a problem that the disciples woke natural curiosity and encourage them to positively address this problem.

Principles of problem-based methods are also contained in other teaching methods based on constructivist learning and heuristics.

PROJECT-BASED LEARNING

Although the "project-based learning based on solving complex theoretical or practical problems under the active work of students" [16], usually at the beginning of most projects tackling mostly in the form of "open questions to which a student seeks an answer can not simply reproduce already acquired knowledge. In seeking solutions to the pupil considers the different procedures and is forced facts to analyze, synthesize and compare. In doing so, it uses information from a variety of disciplines. Solving the problem is a dynamic process and thus forcing the student to search for connections, relationships, information from various sources and to evaluate their own experiences. "[17] (p. 83)

The project teaching students to engage in a thorough, extended process of research aimed at solving complex, authentic questions and problems. Students work independently as possible for teachers, and may to some extent influence the learning process themselves. This method helps students to understand the depth of the problems arising during the solution of the students acquire the necessary knowledge and skills. Simultaneously with them to develop a method called. 21st century skills such as collaboration, critical thinking and communication. The result of the efforts of students on solving complex problems arise from the final product (generally

output), which is presented to the audience as well as the practices advocated in the implementation of the selected product. [18]

INQUIRY-BASED LEARNING

Concepts such as inquiry-based teaching or research-oriented teaching are used to naming method based on self-directed research and examining students. According to the external management Students:

- own practice verify the results previously known to them in advance provided together with the initial procedure and problematic issue. In this case it is called. Confirmatory research.
- formulate an explanation of the phenomenon studied when they know in advance the question of the initial problem and possible advancement. Known as structured inquiry.
- create a methodology which also implemented on the basis of previously known problematic issues. This process is called. Directed research.
- to ask the initial question problematic, think over and consider methodical process solutions practically test their proposed procedure and formulate results. Highest level of inquiry-based learning, called as an open inquiry. [19]

DELPHI METHOD

Also, this method is often categorized as techniques that allow us to find solutions to the problem. It is all about a gradual process consisting of several stages. In the initial phase, the individual members of the research team behind him to express solved problem, frequently writing to his arguments could influence the consideration of his co-investigators. Trying to assess the problem from different perspectives and come up with their own solutions or propose steps to solve a given problem (forecast) [20]. In the next stage, the forecasts investigators handled by another member (Group) team, which performs penetration of the information obtained, summarizes the results and submit them for consideration solvers. In one of the final phase, the researchers thus treated, and the results indicate that when they are forced to consider other proposed solutions. Individual expression are then again processed and gradual "filtering" should thus lead to a common, for all members of an acceptable solution. [26]

PRINCIPLES OF UNIVERSITY EDUCATION

Following the theme dedicated to the interests of students studying at the university is not too surprising when the university teachers generally believe that students to study (learning) binds primarily extrinsic motivation, which is purposefully chasing after completing the prescribed tests and other study obligations, so as to obtain a university diploma. The aim of higher education would not be contrary to promote internal motivation of students, arouse their interest in knowledge and self-development, and positively influence the course and effects of their study (learning). [23] (p. 174) In line with this objective, following conclusions were reached, which comes from the research P. Ramsden, in which the terms of the characteristics of a good university teacher [22]:

- A good teacher is also a good student - are still being educated in their field, he is involved in various professional activities that help him continually improve in their field, listening to students share their thoughts and ideas with colleagues and interact with students taking account of their achievements.
- A good teacher shows enthusiasm for his subject and shows a desire to share it with their students.

- A good teacher knows how to adapt their teaching strategies specific to students learning topic and learning environment.
- A good teacher promotes learning and understanding among their students focus on developing skills in the areas of critical thinking, problem solving and skills to act in problem situations.
- A good teacher demonstrates the ability to transform and expand their knowledge, which also draws on new knowledge in their fields of knowledge of their students' general educational knowledge can connect with the subject, and create concepts that are understandable to his students.
- A good teacher sets clear objectives, adequate use appropriate methods of evaluation and provides its students with quality feedback.
- A good teacher honors and respects her students interested in their professional and personal growth, promotes their independence and puts his hope in them.

Those characteristics still further processed J. Vašutová [21] (pp. 186-189). Of characteristics can be seen that university teachers are in connection with his profession placed considerable demands. Should all of these criteria (characteristics) of a good teacher, a high school meet, it is almost inconceivable that, for the purposes of teaching their elected only teaching strategies based on transmissive information.

CONSTRUCTIVISM IN UNIVERSITY EDUCATION

"Pedagogical constructivism is sometimes defined as the effort to overcome the transmissive teaching, which is seen as the definitive transfer of educational content for students who are in fact doomed to a passive role of their beneficiaries." [14] (p. 49)

In the pedagogical constructivism are learning is considered an individual process in which the student is actively working with the submitted information with their own experience and knowledge. In active discussion with the teacher and classmates are forced to critically evaluate their findings, which reflect his opinions and attitudes. In doing so, he creates his own structures of knowledge and creates new attitudes. [9], [10].

The constructivist approach to teaching, we can find some essential features of project based learning. In the current educational terminology, project-based learning is considered to be one of the typical methods of constructive school. [17] (p. 90)

LITERATURA

[1] Studenti a absolventi vysokých škol. In: *Český statistický úřad* [online]. 2010 [cit. 2012-03-12]. Dostupné z: http://www.czso.cz/csu/redakce.nsf/i/studenti_a_absolventi_vysokych_skol_v_cr_celkem/$File/1_VS_studenti_celkem_11.pdf

[2] Studenti v terciárním vzdělávání (ISCED 5-6), podle regionů NUTS 2. In: *European commission : Eurostat* [online]. 2012 [cit. 2012-12-17]. Dostupné z: http://apl.czso.cz/pll/eutab/html.h?ptabkod=tgs00094

[3] *Organisation for Economic Co-operation and Development* [online]. 2006 [cit. 2012-5-13]. Report on the Evolution of Student Interest in Science and Technology Studies. <http://www.oecd.org/dataoecd/16/30/36645825.pdf>.

[4] BÍLEK, M. Zájem žáků o přírodní vědy jako předmět výzkumných studií a problémy aplikace jejich výsledků v pedagogické praxi [on line], Acta Didactica, FPV UKF Nitra, 2008, roč. 2 [cit. 20.12. 2010] s. 1-15.

[5] ROCARD, M. et al. *Science Education now: a renewed pedagogy for the future of Europe*. Brussels : European Communities, EUR22845, 2007. 22 s. ISBN 978-92-79-05659-8.

[6] Fakulty a vysoké školy: Zájem uchazečů. *VŠ.scio.cz* [online]. Scio, © 2011 [cit. 2012-06-18]. Dostupné z: http://vs.scio.cz/zajem.asp

[7] O které studijní obory je letos největší zájem?. *VysokeSkoly.cz: Přijímací řízení* [online]. - 2013 [cit. 2013-01-18]. Dostupné z: http://www.vysokeskoly.cz/clanek/technika-stale-nelaka-jako-psychologie

[8] ČÁBALOVÁ, Dagmar. *Pedagogika*. Vyd. 1. Praha: Grada, 2011, 272 s. Pedagogika (Grada). ISBN 978-802-4729-930.

[9] ŠTECH, S. Teoretické přístupy k vysokoškolské výuce. VAŠUTOVÁ, J. *Vybrané otázky vysokoškolské pedagogiky pro vzdělavatele učitelů*. Praha: Ústav výzkumu a rozvoje školství, 1999, s. 157-166. ISBN 80-86039-97-8.

[10] ROHLÍKOVÁ, Lucie a Jana VEJVODOVÁ. *Vyučovací metody na vysoké škole*. 1. vyd. Plzeň: Západočeská univerzita v Plzni, 2010, 104 s. ISBN 978-807-0439-678.

[11] KOTRBA, Tomáš a Lubor LACINA. *Praktické využití aktivizačních metod ve výuce*. Vyd. 1. Brno: Společnost pro odbornou literaturu - Barrister, 2007. ISBN 978-808-7029-121.

[12] MAŇÁK, Josef a Vlastimil ŠVEC. *Výukové metody*. Brno: Paido, 2003, 219 s. ISBN 80-731-5039-5.

[13] ŠTECH, Stanislav. *Škola stále nová: Freinetova "moderní škola, MCE - hnutí pedagogické kooperace, GFEN - Francouzská skupina Nové výchovy*. Vyd. 1. Praha: Karolinum, 1992, 258 s. ISBN 80-706-6673-0.

[14] KALHOUS, Zdeněk a Otto OBST. *Školní didaktika*. Vyd. 2. Praha: Portál, 2009, 447 s. ISBN 978-807-3675-714.

[15] MOŠNA, F.; RÁDL, Z.: Problémové vyučování a učení v odborném školství. Praha: UK-PedF, KTVOV, 1996. ISBN 80-902166-0-9.

[16] SKALKOVÁ, Jarmila. *Obecná didaktika*. Vyd. 1. Praha: ISV nakladatelství, 1999, 292 s. ISBN 80-858-6633-1.

[17] DVOŘÁKOVÁ, Markéta. *Projektové vyučování v české škole: vývoj, inspirace, současné problémy*. 1. vyd. Praha: Karolinum, 2009, 158 s. Učební texty Univerzity Karlovy v Praze. ISBN 978-802-4616-209.

[18] LARMER, J. PBL starter kit : to-the-point advice, tools and tips for your first project in middle or high school. 1st ed. Novato : Buck Institute for Education, 2009. 138 s. ISBN 978-0-9740343-2-4.

[19] STUCHLÍKOVÁ, Iva. O badatelsky orientovaném vyučování. In: *DiBi 2010: didaktika biologie v České republice 2010 a badatelsky orientované vyučování : sborník příspěvků semináře 25. a 26. března 2010*. V Českých Budějovicích: Jihočeská univerzita, 2010, s. 129-135. ISBN

[20] MAŇÁK, Josef. Aktivizující výukové metody. *Metodický portál RVP.CZ*. 2011. Dostupné z: http://clanky.rvp.cz/clanek/c/Z/14483/aktivizujici-vyukove-metody.html/

[21] VAŠUTOVÁ, Jaroslava. *Vybrané otázky vysokoškolské pedagogiky pro vzdělavatele učitelů*. Praha: Ústav výzkumu a rozvoje školství, 1999, 222 s. ISBN 80-860-3997-8.

[22] RAMSDEN, Paul. *Learning to teach in higher education*. New York, NY: Routledge, 1992, xiv, 290 p. ISBN 0-203-41393-8.

[23] VAŠUTOVÁ, Jaroslava. *Strategie výuky ve vysokoškolském vzdělávání*. Praha: Univerzita Karlova v Praze, Pedagogická fakulta, 2002, 283 s. ISBN 80-729-0100-1.

[24] PODLAHOVÁ, Libuše. *Didaktika pro vysokoškolské učitele*. Vyd. 1. Praha: Grada, 2012, 154 s. Pedagogika (Grada). ISBN 978-802-4742-175.

[25] HENDL, Jan. *Kvalitativní výzkum: základní metody a aplikace*. Vyd. 1. Praha: Portál, 2005, 407 s. ISBN 80-736-7040-2.

[26] BÍLEK, Martin, Jiří RYCHTERA a Antonín SLABÝ. *Konstruktivismus ve výuce přírodovědných předmětů*. 1. vyd. Olomouc: Univerzita Palackého v Olomouci, 2008, 31 s. ISBN 978-80-244-1882-7.

Kontaktní adresa

Mgr. Denis Mainz
Katedra výpočetní a didaktické techniky FPE ZČU
Klatovská tř. 51
306 19, Plzeň
telefon: +420 377 636 454
e-mail: dmainz@kvd.zcu.cz